

\* NOTICES \*

JP0 and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is used for flyback type switching power supply, and relates to suitable switching power supply.

[0002]

[Description of the Prior Art] In the conventional flyback type switching power supply, full wave rectification of the output of AC power supply is carried out by the diode bridge circuit etc., for example, it is smoothed by a capacitor etc., and is supplied to the primary coil of a transformer via switching elements, such as a transistor. In such a device, it corresponds to the time which the transistor turns on, or the cycle which a transistor turns on and off, Since current will flow into the secondary coil of a transformer if the cycle through which current flows into time for current to flow into the primary coil of a transformer or the primary coil of a transformer changes, respectively, Smooth rectification of this current is carried out, for example by the diode or a capacitor, and it is supplied to the load connected to the secondary coil of a transformer.

[0003] In this case, in order to make into predetermined value  $V_{C1}$  voltage built over the load connected to the secondary coil of a transformer in the conventional device, For example, ON/OFF of a transistor is controlled so that the voltage corresponding to the voltage in the secondary coil concerning a secondary coil and the 3rd coil provided in the like pole becomes predetermined value  $V_{C2}$  to a transformer.

[0004]

[Problem(s) to be Solved by the Invention] By the way, in such a device, if a heavy load is connected to a secondary coil, for example, a high current will flow, and the voltage in a secondary coil will fall, but since the load in the 3rd coil is constant, the voltage does not change. Therefore, ON/OFF control of the transistor was not carried out so that the voltage in

the secondary coil which fell in this case might be raised.

[0005]Then, the current (drawing 5 (a)) in a primary coil fluctuated corresponding to the current which flows into a secondary coil is detected, and there is the method of amending the voltage in the 3rd coil based on the peak hold value (drawing 5 (b)) of this current. That is, there is the method of amending the voltage in the 3rd coil so that it may become the voltage corresponding to the voltage in a secondary coil which falls when a heavy load is connected to a secondary coil and a high current flows.

[0006]However, in order to raise the power-factor of a device in this method, for example, When the capacitor which performs smoothing after full wave rectification of the output of AC power supply was carried out is removed, the current which flows into a primary coil, Since it changes on frequency (commercial frequency) twice the frequency of AC power supply having as the output (drawing 6) of AC power supply by which full wave rectification was carried out becomes what was switched with the transistor and it is shown in drawing 7, The voltage in the 3rd coil was not amended properly, but the technical problem where the voltage in a secondary coil is not stabilized occurred.

[0007]This invention is made in view of such a situation, and raises the stability of output voltage.

[0008]

[Means for Solving the Problem]This invention is characterized by switching power supply comprising the following.

The full wave rectifier circuit 3 as a rectification means which rectifies an output of AC power supply 1.

The field effect transistor (FET) 8 as a switching means which switches current rectified by the full wave rectifier circuit 3.

The transformer 4 as a coupling means which sends current through secondary coil  $L_2$  and 3rd coil  $L_3$  when current switched by FET8 flows into primary coil  $L_1$ .

Diode  $D_2$  as a voltage detection means which detects voltage corresponding to voltage in secondary coil  $L_2$  of the transformer 4 from 3rd coil  $L_3$  provided in the transformer 4, Capacitor  $C_1$ , resistance  $R_2$ , and  $R_3$ , Current transformer  $L_4$  as a current detecting means which detects current which flows into primary coil  $L_1$  of the transformer 4, The detector circuit 5 as a peak voltage detection means to detect voltage corresponding to a peak value of current detected by current transformer  $L_4$ , The correction circuit 6 as a compensation means which amends voltage detected by diode  $D_2$ , capacitor  $C_1$ , resistance  $R_2$ , and  $R_3$  corresponding to voltage detected by the detector circuit 5, PWM controlling circuit 7 as a control means which controls FET8 corresponding to voltage amended by the correction circuit 6.

[0009]

[Function] In the switching power supply of the above-mentioned composition, the current to which full wave rectification of the output of AC power supply 1 was carried out by the full wave rectifier circuit 3 is switched, and current flows into secondary coil  $L_2$  by flowing into primary coil  $L_1$  of the transformer 4. On the other hand, generate in 3rd coil  $L_3$  provided in the transformer 4. The voltage corresponding to the voltage in secondary coil  $L_2$  is amended by the voltage corresponding to the peak value of the current which flows into primary coil  $L_1$ , and FET8 is controlled based on the voltage corresponding to the voltage in this amended secondary coil  $L_2$ . Therefore, the voltage in secondary coil  $L_2$  can be stabilized.

[0010]

[Example] Drawing 1 is a circuit diagram showing the composition of one example of the flyback type switching power supply adapting the switching power supply of this invention. AC power supply 1 supplies the voltage (current) which has commercial frequency, such as 50 Hz or 60 Hz, for example to the line noise filter 2. The line noise filter 2 removes the noise which has been in the voltage (current) supplied from AC power supply 1, and outputs it to the full wave rectifier circuit 3. The full wave rectifier circuit 3 comprises a diode bridge circuit (not shown), for example, and carries out full wave rectification of the voltage (current) supplied via the line noise filter 2 from AC power supply 1.

[0011] Primary coil  $L_1$  of the transformer 4 is connected to the full wave rectifier circuit 3 via the drain and source of the field effect transistor (FET) 8. FET8, the drain is connected to the end of primary coil  $L_1$  of the transformer 4, and the source is connected to the end of the full wave rectifier circuit 3, respectively.

The gate is connected to PWM controlling circuit 7.

FET8 is turned on and off from PWM controlling circuit 7 corresponding to the driving pulse supplied to the gate, and it controls the current which flows into primary coil  $L_1$ .

[0012] Secondary coil  $L_2$  of the transformer 4 is connected to capacitor  $C_2$  for current smooth via diode  $D_3$ . Diode  $D_3$  is a diode for rectifying the current which flows into secondary coil  $L_2$  of the transformer 4, the anode is connected to the end of secondary coil  $L_2$  of the transformer 4, and the cathode is connected to the end of capacitor  $C_2$ . The both ends of capacitor  $C_2$  are connected to the load 9 of a television receiver etc., respectively.

[0013] As for current transformer  $L_4$ , the one end is connected to the anode of diode  $D_1$ , and the other end is connected to resistance  $R_1$ .

There, the current corresponding to the current to which the current outputted from the full wave rectifier circuit 3 was switched by FET8 flows.

The cathode of diode  $D_1$  is connected to the end of the direction which is not connected with current transformer  $L_4$  of resistance  $R_1$ .

The node of diode  $D_1$  and resistance  $R_1$  is connected to PWM controlling circuit 7.

[0014]The voltage corresponding to the current which carried out rectification smoothing of the current into which the detector circuit 5 flows through the node of current transformer  $L_4$  and diode  $D_1$ . That is, the voltage corresponding to the peak value of the current which flows through the node of current transformer  $L_4$  and diode  $D_1$  is detected, and the correction circuit 6 is supplied.

[0015]As for 3rd coil  $L_3$  of the transformer 4, the one end is connected to the anode of diode  $D_2$ , and the other end is grounded.

The same polar voltage as secondary coil  $L_2$  is generated.

That is, 3rd coil  $L_3$  generates the voltage corresponding to the voltage concerning the load 9 connected to secondary coil  $L_2$ , i.e., the voltage concerning capacitor  $C_2$ . As for capacitor  $C_1$ , the one end is connected to the cathode of diode  $D_2$ , and the other end is grounded. The end of the direction which resistance  $R_2$  and  $R_3$  are connected in series, and is not connected with resistance  $R_3$  of resistance  $R_2$ . The end of the direction which is connected at the node of diode  $D_2$  and capacitor  $C_1$ , and is not connected with resistance  $R_2$  of resistance  $R_3$  is grounded. The node of resistance  $R_2$  and resistance  $R_3$  is connected to the correction circuit 6. Therefore, the series circuit which consists of resistance  $R_2$  and  $R_3$  carries out the partial pressure of the voltage in the node of diode  $D_2$  and capacitor  $C_1$ , and supplies it to the correction circuit 6.

[0016]The correction circuit 6 receives the input of the voltage corresponding to the peak value of the current which flows through the node of current transformer  $L_4$  and diode  $D_1$ , i.e., the voltage corresponding to the peak value of the current which flows through the primary coil of the transformer 4, from the detector circuit 5. And the voltage generated in 3rd coil  $L_3$  based on this voltage, A peak hold is carried out by diode  $D_2$  and capacitor  $C_1$ . The voltage by which the partial pressure was carried out by resistance  $R_2$  and  $R_3$  is amended on the voltage

corresponding to the voltage concerning capacitor  $C_2$  (load 9) connected to secondary coil  $L_2$  via diode  $D_3$ , and is outputted to PWM controlling circuit 7.

[0017]As for resistance  $R_4$ , the one end is connected at the node of the full wave rectifier circuit 3 and primary coil  $L_1$ , and the other end is connected to PWM controlling circuit 7. The output voltage of the full wave rectifier circuit 3 is supplied to PWM controlling circuit 7.

[0018]The voltage to which PWM controlling circuit 7 is supplied from the full wave rectifier circuit 3 via resistance  $R_4$ , And the voltage in the node of diode  $D_1$  and resistance  $R_1$ , That is, from the voltage concerning primary coil  $L_1$ , and the voltage corresponding to the current which flows into primary coil  $L_1$ , the driving pulse of an ON/OFF sake is outputted for the current which flows into primary coil  $L_1$  to the gate of FET8 so that the power-factor of a device may be improved most. PWM controlling circuit 7 so that voltage supplied from the correction circuit 6 may be made into a predetermined value, That is, the driving pulse of an ON/OFF sake is outputted for the current which flows into primary coil  $L_1$  to the gate of FET8 so that voltage concerning capacitor  $C_2$  connected to secondary coil  $L_2$  and parallel via diode  $D_3$  may be made into the rated voltage value of the load 9.

[0019]Next, the operation is explained. If a device is started, while the driving pulse for starting will be impressed to the gate of FET8 from PWM controlling circuit 7, For example, the output of AC power supply 1 which has commercial frequency, such as 50 Hz or 60 Hz, is supplied to the full wave rectifier circuit 3 via the line noise filter 2, and full wave rectification is carried out in the full wave rectifier circuit 3.

[0020]In FET8, according to the cycle and pulse width of a driving pulse for starting which are impressed to the gate from PWM controlling circuit 7, If between the drain and source is turned on and off, the current (drawing 2) by which full wave rectification was carried out will flow through primary coil  $L_1$  of the transformer 4 in the full wave rectifier circuit 3 corresponding to switching of FET8 (drawing 3). (if switched)

[0021]Simultaneously, while the output voltage from the full wave rectifier circuit 3 is supplied to PWM controlling circuit 7 via resistance  $R_4$ , The output current from the full wave rectifier circuit 3 (drawing 3), i.e., the current which flows through primary coil  $L_1$ , is detected by current transformer  $L_4$ , it flows through diode  $D_1$  and resistance  $R_1$ , is transformed into voltage by resistance  $R_1$ , and is supplied to PWM controlling circuit 7. That is, the output voltage from the full wave rectifier circuit 3 and the voltage corresponding to the output current from the full wave rectifier circuit 3 are supplied to PWM controlling circuit 7.

[0022]In PWM controlling circuit 7, the driving pulse for sending current through primary coil  $L_1$  from the output voltage from the full wave rectifier circuit 3 and the voltage corresponding to output current, so that the power-factor of a device may be improved most is impressed to the gate of FET8.

[0023]When FET8 is an ON state, the current by which full wave rectification was carried out in the full wave rectifier circuit 3 flows through primary coil  $L_1$ , and magnetic flux occurs in the transformer 4. If FET8 will be in an OFF state, the magnetic flux through which current would not flow into primary coil  $L_1$  and which was generated in the transformer 4 will begin to decrease, but voltage (back electromotive force) occurs in secondary coil  $L_2$  and 3rd coil  $L_3$  so that change (reduction) of this magnetic flux may be opposed.

[0024]The current corresponding to the voltage (back electromotive force) generated in secondary coil  $L_2$  flows into capacitor  $C_2$  via diode  $D_3$ . The voltage corresponding to the electric charge which the electric charge was charged by capacitor  $C_2$  and charged by capacitor  $C_2$  is impressed to the load 9.

[0025]On the other hand, the current corresponding to the voltage (back electromotive force) generated in 3rd coil  $L_3$  flows into capacitor  $C_1$  via diode  $D_2$ . The voltage corresponding to the electric charge which the electric charge was charged by capacitor  $C_2$  and charged by capacitor  $C_2$  is impressed to the end of the direction which is not connected with resistance  $R_3$  of resistance  $R_2$ .

[0026]Here, since 3rd coil  $L_3$  has the same polarity as secondary coil  $L_2$  as mentioned above, the voltage corresponding to the voltage which secondary coil  $L_2$  generated, i.e., the voltage impressed to the load 9, (voltage of the both ends of capacitor  $C_2$ ) occurs to the both ends of the 3rd coil. Therefore, the voltage corresponding to the voltage (voltage of the both ends of capacitor  $C_2$ ) impressed to the load 9 is impressed to the end of the direction which is not connected with resistance  $R_3$  of the node of capacitor  $C_1$  and diode  $D_2$ , i.e., resistance  $R_2$ .

[0027]The voltage corresponding to the voltage (voltage of the both ends of capacitor  $C_2$ ) impressed to the load 9 impressed to the end of the direction which is not connected with resistance  $R_3$  of resistance  $R_2$ . In the series circuit which consists of resistance  $R_2$  and  $R_3$ , a partial pressure is carried out to the rated input voltage of the correction circuit 6, and the correction circuit 6 is supplied.

[0028]Here, when the load 9 is a heavy load (device with heavy load), for example, much current flows into the load 9 and the voltage (voltage concerning the load 9) of the both ends of

capacitor  $C_2$  descends. However, since the load (impedance seen from 3rd coil  $L_3$ ) in 3rd coil  $L_3$  is constant, Voltage higher than the voltage corresponding to the voltage (voltage concerning the load 9) of the both ends of capacitor  $C_2$  which descends when much current flows into the load 9 occurs in 3rd coil  $L_3$ .

[0029]Then, the voltage (drawing 4) corresponding to the current which flows into secondary coil  $L_2$  is detected from the current (drawing 3) which flows into primary coil  $L_1$  detected by current transformer  $L_4$  in the detector circuit 5. Namely, the current in secondary coil  $L_2$  (primary coil  $L_1$ ), Since it flows so that it may be proportional to the current which flows into primary coil  $L_1$  (secondary coil  $L_2$ ), In the detector circuit 5, the peak hold of the current (drawing 3) which flows into primary coil  $L_1$  detected by current transformer  $L_4$  is carried out by a capacitor with large capacity to build in (not shown) (drawing 4), and it is supplied to the correction circuit 6.

[0030]The current which flows into primary coil  $L_1$  detected by current transformer  $L_4$  here, Since full wave rectification of the output of AC power supply 1 is carried out in the full wave rectifier circuit 3 (drawing 2) and it is switched by FET8, as shown in drawing 3, it has commercial frequency twice the frequency of the output of AC power supply 1 having. For this reason, as mentioned above, in the detector circuit 5. The peak hold (smoothing) of the current which flows into primary coil  $L_1$  detected by current transformer  $L_4$  by a capacitor with large capacity to build in is carried out (drawing 4), and the influence of commercial frequency twice the frequency of in this current is reduced.

[0031]In the correction circuit 6, the voltage the partial pressure was carried out [ voltage ] by resistance  $R_2$  and  $R_3$  is amended by the voltage supplied from the detector circuit 5, and is supplied to PWM controlling circuit 7. Namely, [ higher than the voltage corresponding to the voltage (voltage concerning the load 9) of the both ends of capacitor  $C_2$  which descends in the correction circuit 6 when much current flows into the load 9 ] The voltage in 3rd coil  $L_3$  with the voltage corresponding to the current which flows into primary coil  $L_1$  proportional to the current in secondary coil  $L_2$ . It is amended by the voltage corresponding to the voltage (voltage concerning the load 9) of the both ends of capacitor  $C_2$  which descends when much current flows into the load 9, and PWM controlling circuit 7 is supplied.

[0032]In PWM controlling circuit 7, the voltage supplied from the correction circuit 6 so that it may become a predetermined value, That is, the current which flows into primary coil  $L_1$  is impressed to the driving pulse of an ON/OFF sake at the gate of FET8 so that voltage

concerning capacitor  $C_2$  connected to secondary coil  $L_2$  via diode  $D_3$  may be made into the rated voltage value of the load 9.

[0033] In FET8, the current which flows into primary coil  $L_1$  is turned on and off according to the driving pulse impressed to the gate from PWM controlling circuit 7.

[0034]. Thus, in the correction circuit 6, generate in 3rd coil  $L_3$ . In [ the voltage corresponding to the voltage in secondary coil  $L_2$  is amended by the voltage which reduced the influence of commercial frequency twice the frequency of the current which flows into primary coil  $L_1$  having, and ] PWM controlling circuit 7, FET8 is controlled so that the voltage corresponding to the voltage in this amended secondary coil  $L_2$  becomes a predetermined value. Therefore, the voltage in secondary coil  $L_2$  can be stabilized.

[0035]

[Effect of the Invention] As mentioned above, according to the switching power supply of this invention, the current with which the output of AC power supply was rectified by the rectification means is switched, and current flows into a secondary coil and the 3rd coil by flowing into the primary coil of a coupling means. The voltage corresponding to the voltage in a secondary coil generated on the other hand in the 3rd coil provided in the coupling means, Since it is amended by the voltage corresponding to the peak value of the current which flows into a primary coil and a switching means is controlled based on the voltage corresponding to the voltage in this amended secondary coil, the output voltage of a secondary coil can be stabilized.

---

[Translation done.]



## \* NOTICES \*

JP0 and INPIT are not responsible for any damages caused by the use of this translation.

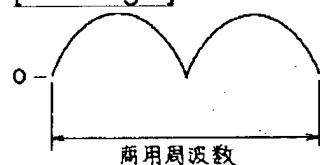
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

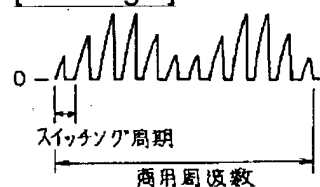
DRAWINGS

---

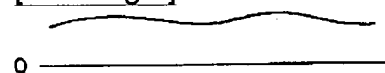
[Drawing 2]



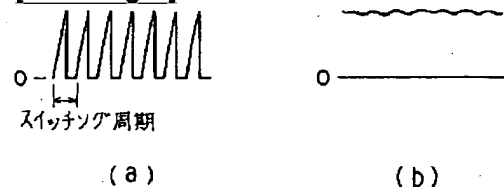
[Drawing 3]



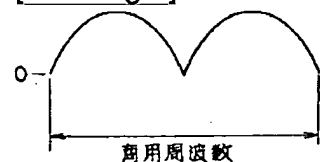
[Drawing 4]



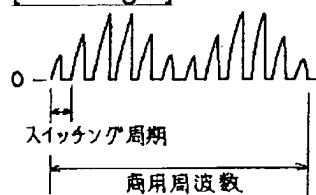
[Drawing 5]



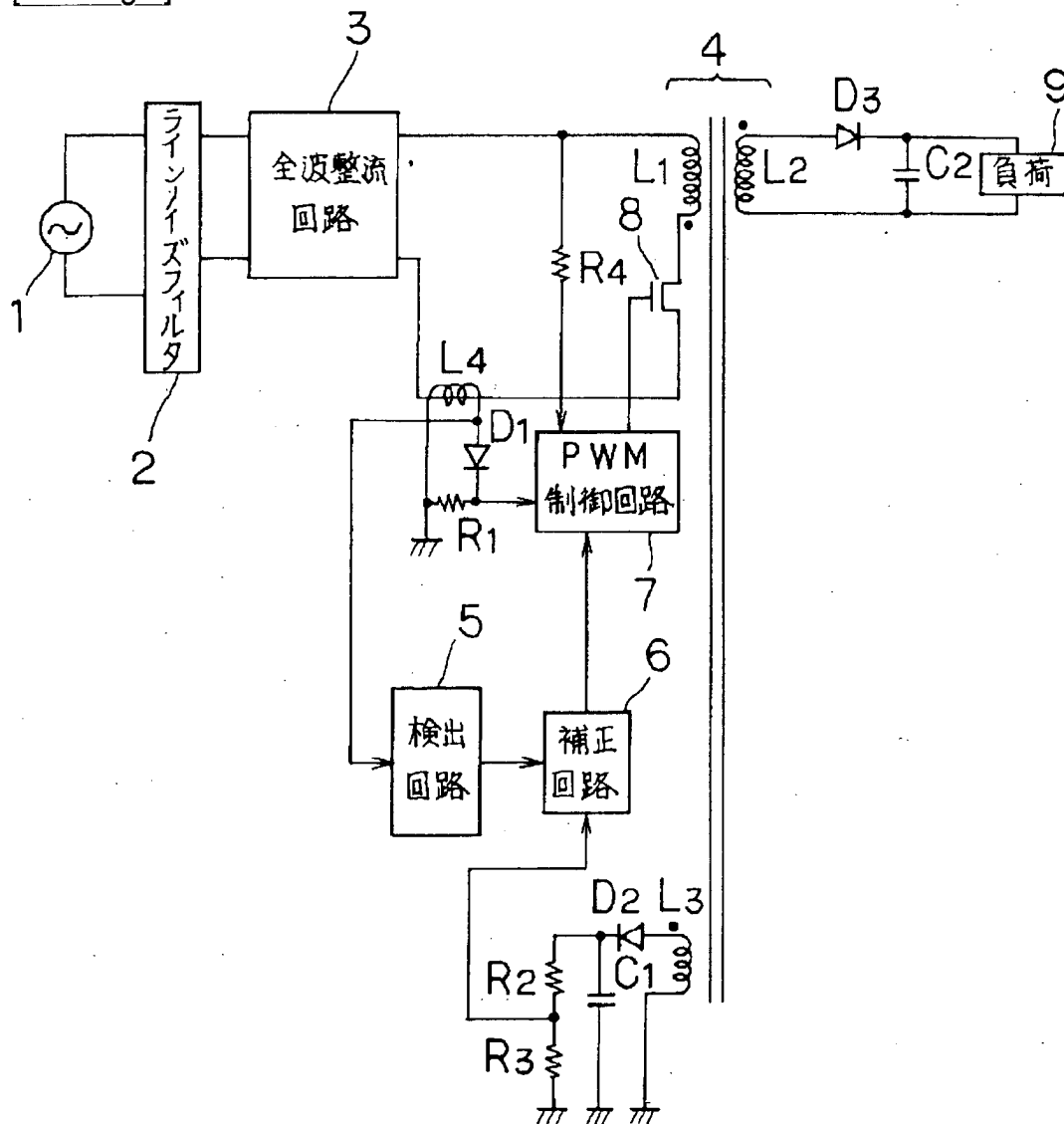
[Drawing 6]



[Drawing 7]



[Drawing 1]



[Translation done.]